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Department of Health
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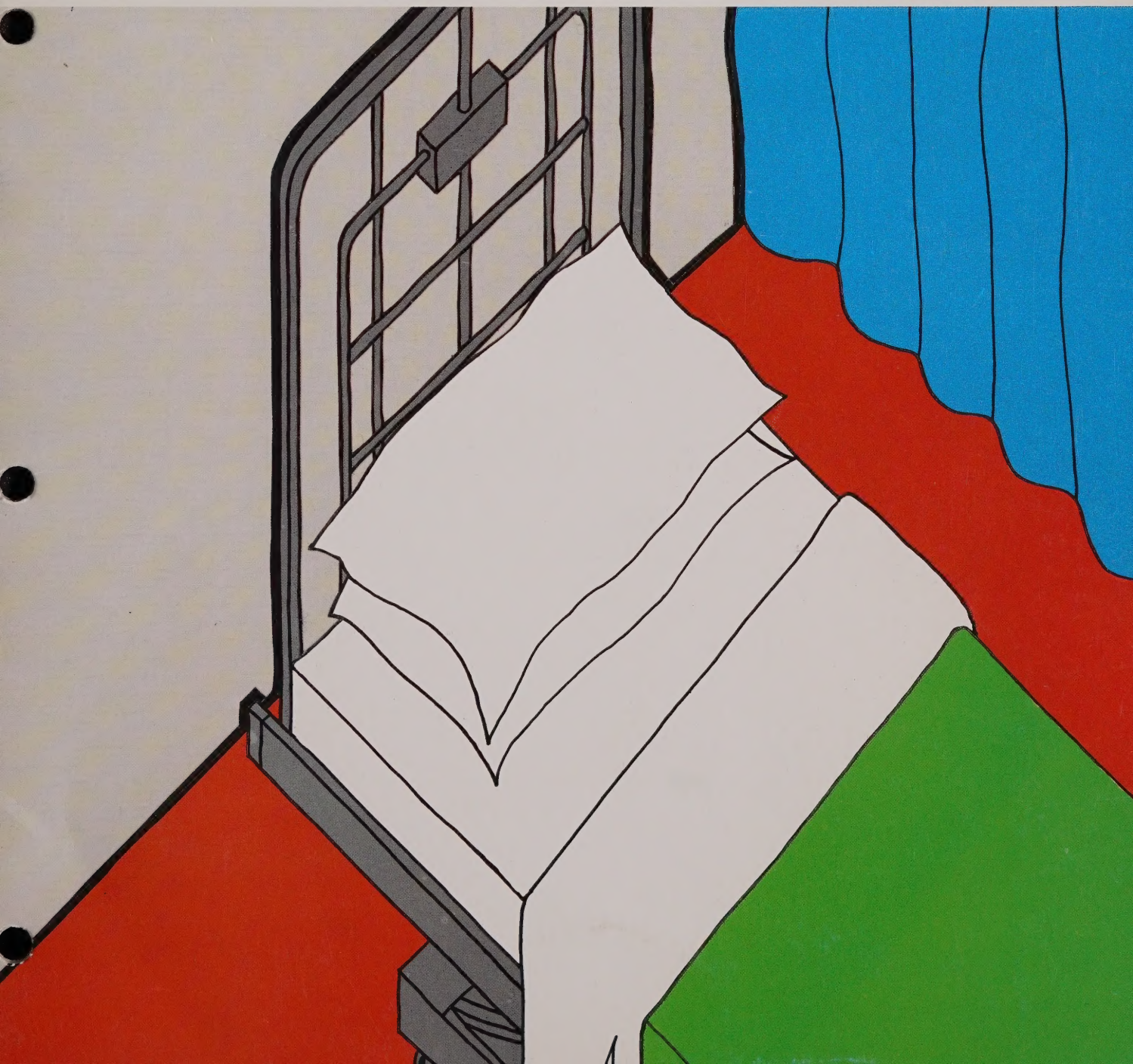
Health
Technical
Memorandum 87

FIRECODE

Textiles and Furniture



Department of Health
and the Welsh Office

FIRECODE

Textiles and Furniture

Health Technical Memorandum 87

London
Her Majesty's Stationery Office

FIRECODE brings together in one comprehensive suite of documents the Department's policy and technical guidance on fire precautions in hospitals and other NHS premises.

Basic policy, principles and key management guidance are contained in *Firecode: Policy and Principles.* Other *FIRECODE* documents include the *Health Technical Memoranda '80'* series (which give technical guidance on various building, engineering and equipment issues) and the *Fire Practice Notes* series (dealing with various specialist aspects of fire precautions) and Nucleus guidance. Existing HTMs will, in due course, be reissued in *FIRECODE* format. The suite includes *Firecode: Directory of Fire Documents* which lists references to relevant legislation and relevant fire precautions guidance issued by non-DH sources (as, for example, the Home Office).

For the convenience of the user, a *FIRECODE* binder and slip case are available for the storage of the constituent *FIRECODE* documents. The binder includes details of the publications which make up *FIRECODE*.
The *FIRECODE* binder, reference ISBN 0 11 321097 3, is available from HMSO Books, PO Box 276, Nine Elms Lane, London SW8 5DT.

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Contents

		Page
1.	**Introduction**	1
2.	**General**	2
2.1	Scope	
2.3	Background	
3.	**Furniture**	
3.1	General	
3.2	Furniture in wards	
3.3	Bedsteads and divans	
3.4	Overbed tables	
3.5	High risk storage furniture	
3.6	Wooden-framed upholstered chairs	
3.8	Metal-framed upholstered chairs	
3.9	Polypropylene chairs	
3.10	Loose covers	
3.11	Totally soft play products	
3.12	Upholstered garden furniture	
4.	**Furnishings**	5
4.1	Curtains	
4.2	Curtains, cotton fabrics	
4.3	Curtains, other fabrics	
4.5	Venetian blinds	
4.6	Roller blinds	
4.7	Vertical blinds	
4.8	Textile floor coverings (carpets)	
4.10	Hard floor coverings	
5.	**Bed Assemblies**	6
5.1	Textiles, general	
5.8	Textiles, blankets	
5.9	Textiles, sheets and pillowslips	

5.12 Textiles, counterpanes

5.15 Textiles, quilts

5.19 Fleece underlay and padding - washable

5.20 Patient supports, mattresses and mattress covers

5.26 Patient supports, pillows

6. Apparel 9

6.1 General

6.2 Sleepwear

6.3 Dressing gowns and bed jackets

7. Disposables 10

7.1 Sheets, pillowslips, drapes and bibs

7.4 Incontinence pads

8. Fire Behaviour 11

8.1 Reaction to fire, furniture

8.2 Reaction to fire, textiles

8.6 Reaction to fire, apparel

8.8 Reaction to fire, polyurethane foam

8.9 Hazards from burning materials, heat transfer

8.13 Hazards from burning materials, toxicity

8.16 Testing for fire behaviour, textiles

8.18 Testing for fire behaviour, upholstery materials

9. Cleansing 13

9.1 General

9.2 Flame retardant cotton fabrics

9.10 Fabrics from synthetic fibres

9.11 Dry cleaning

10. Marking 14

10.1 Furniture

10.2 Furnishings

10.3 Furnishings, curtains

10.4 Furnishings, net curtains

10.5 Furnishings, roller blinds

10.6 Textiles, counterpanes

10.7 Textiles, blankets

10.8 Textiles, quilt covers

10.9 Textiles, primary mattress covers and pillow covers

10.10 Textiles, nightwear including dressing gowns

APPENDICES

1. Relevant British Standards and TCS Fire Retardant/Test Specifications. 15

2. Garment label trade name - low hazard level fibres. 17

3. Flame retardant treatments. 18

4. DH Fire Retardant Label. 19

5. The Furniture and Furnishings (Fire) (Safety) Regulations 1988 - Scope of application. 20

1. Introduction

1.1 This publication is intended as a guide for those who purchase and/or use furniture and textiles in health care buildings, and others with a responsibility for fire precautions in the National Health Service.

1.2 Some chapters and appendices are of special interest to particular disciplines, and whilst much of the content relates to hospitals, the principles propounded apply also to other health care premises.

1.3 This Memorandum, together with related technical memoranda on design, general and specialist aspects of fire safety, constitutes the "Memorandum of Guidance" to which reference was made by the Home Secretary in a Statement [(a)] in the House of Commons on 23 April 1980. As such, it supplements the Home Office's Draft Guide to Fire Precautions in Hospitals, dated September 1982.

1.4 References are made in the text to the Health Service Supply Purchasing Guide (HSSPG), an NHS publication circulated to health authorities only. This Guide contains details of items available under NHS national contract and of suppliers and specifications in respect of some other products. For any products covered by those references, it is suggested that local authority Social Service Departments should seek the collaboration of the Supplies Officer of the appropriate health authority. Some of the products are already directly available to local authorities under arrangements made by the Crown Suppliers.

1.5 Health authorities will need to exercise control over patients' clothing available through hospital shops to ensure compliance with advice given in this publication. For the same reason, staff who accompany patients on shopping expeditions or who are in contact with relatives about brought-in clothing, furniture or furnishings will need to know of this advice.

1.6 It is the responsibility of health authorities to ensure, as far as possible, that all items donated or purchased with financial contributions from voluntary bodies and other sources are suitable for use by, or for the care of, patients. In the context of this Memorandum this means that the items should be of a reduced fire hazard level where such a quality is available. To achieve this, health authorities should endeavour to secure advance consultation with organisations, such as Leagues of Friends and Rotary Clubs, which propose making gifts.

1.7 The advice now given in this document is commended to health authorities though it is appreciated that any action taken to follow it depends on financial resources available and the priorities of competing demands upon those resources. Nevertheless, all new hospitals and those with new extensions and major alterations should be equipped at their commissioning stage with textiles and furniture meeting the requirements of this Memorandum. In order to maintain fire safety standards at their initial level, textiles and furniture to lower standards of safety should not be introduced at later stages.

1.8 In existing health buildings every effort should be made to improve safety standards as resources permit. Patient areas assessed as having the highest fire risks should receive priority consideration for improvement.

[(a)] Hansard, Written Answers, 23 April 1980, cols 139-141.

2. General

Scope

2.1 This publication deals with the improvement of the fire safety level in health buildings by identifying non-building materials which, when used by themselves or in conjunction with others, do not ignite easily and have a low flame-rate and spread, so that the development of fire, if not prevented altogether, is at least delayed. Thus the early detection of a fire will afford time for putting it out and for evacuating patients before flames and the products of combustion make the environment untenable.

2.2 Guidance is provided on the purchase of such materials, textiles in particular, and their behaviour when subjected to fire.

Background

2.3 The hazards arising from the burning of furniture and textiles depend on the overall fire characteristics and environment. There is no truly "flameproof" material; the best that can be achieved is a given level of resistance to fire, thereby reducing the fire hazard level.

2.4 The fire behaviour of textiles and supports (eg mattresses) used in health care premises is of considerable importance. The fire hazard risks of these materials, and the smoke and toxic gases produced by their combustion cannot be entirely reduced or contained by operational means, such as improved methods of escape, fire detection or smoke extraction.

2.5 A high proportion of fires in hospitals originate in wards and involve textiles and furnishings. A frequent cause of such fires is smokers' materials which when lit and handled carelessly can result in major fires. It is recognised that ward staff play a leading role in the supervision of smokers and the detection and confinement of fire.

2.6 Advances in materials technology may gradually decrease the fire risk but will not eliminate it entirely, and it is, of course, essential that materials used on and around the patient should provide comfort and be aesthetically acceptable. It is stressed that particular products are referred to in this text because they are acceptable in relation to flammability - no claims are made for clinical efficacy.

3. Furniture

General

3.1 This chapter deals with furniture in wards and other hospital areas used by patients. The degree of fire risk of individual items is mentioned, where appropriate, and information is also given about the availability of items with a reduced fire hazard level. The Furniture and Furnishings (Fire) (Safety) Regulations 1988 (SI 1988 No. 1324) introduced more stringent fire safety requirements for furniture ordinarily intended for private use in a dwelling (see Appendix 5). The fire safety requirements for furniture for health care premises recommended in this Memorandum provide at least the same fire safety standard as these Regulations.

Furniture in wards

3.2 Ward furniture apart from bedsteads and some divans is mainly made from wood and is therefore relatively difficult to ignite. It can, however, contribute significantly to a fire once the fire has developed, and the spread of flame will vary with the amount of furniture and its position. Also, there are possible interactions of furniture and textiles, particularly where the burning of one item acts as an ignition source for adjacent items, or produces flame and hot gases to cause spread of fire over greater distances. The degree of risk therefore varies with particular situations. Furniture for especially high risk areas is dealt with in paragraph 3.5.

Bedsteads and divans

3.3 Most bedsteads in ward areas, other than those for long-stay patients, are likely to be of the King's Fund or other all-metal type and will not present a fire hazard. Either the metal wire-mesh or solid metal base type is suitable but increasingly the solid metal base is finding disfavour because of its tendency to collect liquid under the mattress which cannot escape. Where divans are used it is recommended that these should be of an all-metal frame construction. However, it is accepted that local judgements which should be backed by the health authority may lead to the use of solid timber beds where it is considered there is a balance of advantage for the particular patients concerned (for example, through the creation of a more homely environment) in allowing a margin of risk to arise. To minimise fire risks such beds should have a flame retardant finish having Class 1 rating for spread of surface flame to British Standard BS 476: Part 7. If headboards for divans are considered essential they should be faced on both sides with a finish to a standard equivalent to that of melamine laminate with the same Class 1 rating for spread of surface flame. The edges should be lipped with an intumescent lacquer finish. Any polyurethane foam used in divans and padded headboards should be of the combustion modified type and to the standard outlined in the final part of paragraph 3.6.

Overbed tables

3.4 Overbed tables should conform to BS 2483.

High risk storage furniture

3.5 The policy of creating a more domestic environment for long-stay patients has led to a desire to provide such patients with greater privacy by sub-dividing multi-bed areas, by means of a screen and providing carcass furniture. Health authorities are strongly recommended to follow the advice given in the High Risk Storage Furniture Report before purchasing such furniture. A copy of the Report is available from the South Western Regional Health Authority.

Wooden framed, upholstered chairs

3.6 Some researchers have concentrated on the ignition properties of various upholstery covers and foam infills and it has been possible to produce upholstered wooden-framed seating (upright, easy and semi-easy chairs) which is flame retardant (FR) to an acceptable standard. BS 5852: Part 1 details test methods for ignition by smokers' materials, ie a smouldering cigarette (source 0) and a lighted match (source 1). However all upholstered chairs currently available from NHS national contracts are required to meet a higher ignition source standard namely, BS 5852: Part 2, ignition source 5 in addition to source 0. There is now irrefutable evidence that once there is ignition and flames penetrate the non-FR polyurethane foam infill of a chair, the fire develops quickly and with it the potentially lethal additional hazards of smoke and toxic gases. The composite of upholstery cover material and foam infill is therefore of the utmost importance. Combustion modified FR foam suitable for upholstered furniture has been developed to meet Schedule 1 Part 1 of the flammability requirement of the Furniture and Furnishings (Fire) (Safety) Regulations 1988. This requirement is a BS 5852: Part 2 test with a specified

FR polyester flat woven cover over the foam. A pass result is achieved with ignition source 5 crib and compliance with a specified mass loss.

3.7 Vinyl and other covers available from NHS national contracts meet the required FR standard. These include fabrics made from 100% wool, and wool blended with a variety of man-made/synthetic fibres (see HSSPG Section T). In most cases an interlining of FR calico is used in conjunction with these materials in order to achieve the necessary pass standard in accordance with the FR Specification and related ignition source 5. It follows that protection by an approved covering material will cease to be effective if the material is torn or damaged. Care should be taken to ensure that only approved materials are specified for the re-upholstering of chairs.

Metal-framed upholstered chairs

3.8 Being metal-framed, this type of furniture is a lesser fire risk than wooden-framed seating. Nevertheless, the upholstery is just as vulnerable and the same FR standards apply. There are NHS national contracts for metal-framed seating, including dining chairs, swivel office chairs, typist/posture chairs, easy chairs and bench seating, which specify the same FR standard as applies to contracts for wooden-framed seating.

Polypropylene chairs

3.9 It has been found possible to produce a polypropylene chair which will meet the same FR standard as for wooden and metal framed seating. As a result, the current NHS national contracts provide for chairs which will meet BS 5852: Part 2 ignition source 5.

Loose covers

3.10 If there is a specific requirement for loose covers these should meet the FR standard for upholstery detailed in the Crown Suppliers Fire Test Specification (FTS) No 3 and related ignition source 5. There are no NHS national contracts for loose covers but replacement covers are available to fit the Crown Suppliers Whitley Range of office seating. (See HSSPG, Section T). However, it should be noted that these covers are not flame retardant and, if specified, they should be used only with an acceptable FR interliner.

Totally soft play products

3.11 Although not furniture as such, totally soft play products are used in some health care premises. The volume of polyurethane foam contained in the various shapes is considerably greater than that used in conventional foam filled furniture and has raised concern about fire safety. Some of these products are covered with flame retarded PVC material but other items are not covered at all. It is recommended that samples should withstand ignition sources 0 and 5 of BS 5852: Parts 1 and 2, and full depth FR foam to the requirements of the Furniture and Furnishings (Fire) (Safety) Regulations 1988 Schedule 1 Part 1 should be used. In general scrupulous observance of fire precautions is necessary where products comprising a totally soft play environment are used and stored.

Upholstered garden furniture

3.12 Upholstered garden furniture may be used by patients, outdoors and indoors, and stored indoors. The recommended FR requirements (dependent on type of filling material) are outlined in the Furniture and Furnishings (Fire) (Safety) Regulations 1988.

4. Furnishings

Curtains (Cubicle, window and mobile screens)

4.1 Curtains, and particularly cubicle curtains, should be flame retardant. Fire spreads more rapidly upwards than sideways and unless contained it will spread, usually gathering momentum as it proceeds. Cubicle curtains around a bed can play a significant part in containing a bed fire.

Cotton fabrics

4.2 Proban and Pyrovatex treated cotton fabrics are recommended materials (see Appendix 3). These meet BS 5867: Part 2 (paragraph 5.3 amended) requirements and FR 7 using ignition source 0 and 5 and are available in piece lengths and as made-up curtains in a wide range of patterns and colourways under NHS national contract (see HSSPG, Section T). (For matching counterpanes see Section 4 of HSSPG, sub-section 4.1.4). It must be emphasised that retaining flame retardant effectiveness of all chemically-treated FR fabrics is dependent on the correct laundry procedures being followed. (See Section 9. DHSS Safety Information Bulletin SIB(86)14, January 1986, also refers.)

Other fabrics

4.3 100% modacrylic and 100% FR polyester curtains are also recommended and should meet BS 5867: Part 2 (paragraph 5.3 amended) after one wash and FR 7 using ignition sources 0 and 5. Some chlorofibre curtainings meet the flammability standard but are only suitable for dry cleaning and should be labelled 'Dry clean only'.

4.4 FR curtain lining is available from contractors and should be used if FR curtains are to be lined. Blackout curtaining material in a FR fabric is also available on NHS national contract. Net curtains and net curtaining materials of 100% FR polyester fibre which meet FR 7, using ignition source 5, are also available under NHS national contract.

Blinds

Venetian blinds

4.5 These are no longer available under a NHS national contract but, although not specifically described as flame retardant, can be so regarded provided only blinds with metal slats are specified by purchasing authorities.

Roller blinds

4.6 Roller blinds made of fibre glass or a Proban or Pyrovatex treated material are obtained on a supply and fix/supply basis on NHS national contract. The FR standard is that defined in FTS 17, using ignition source 5.

Vertical blinds

4.7 When cloth-type vertical blinds are used in patient areas the flame retardant type should be purchased.

Floor coverings

Textile floor coverings (carpets)

4.8 Textile floor coverings are not considered to be a serious fire hazard but all makes of soft floor covering used should have been tested to BS 4790 and rated as defined in BS 5287.

4.9 Carpets rated as 'high radius of ignition' are not available on NHS national contracts. Carpets rated as 'low radius of ignition' should be used in areas designated as being high fire risk. Textile floor coverings bonded to the floor present a lower fire risk than textile floor coverings loosely laid.

Hard floor coverings

4.10 The Fire Research Station does not consider hard floor coverings a fire risk. Nevertheless, some floor coverings such as linoleum and PVC sheets and tiles will add to the overall fuel loading. PVC sheets and tiles contribute to the release of irritant and toxic products and may interact with other items to spread flames further.

5. Bed Assemblies

Textiles

General

5.1 Ignition of textile products such as bedding and clothing is the principal cause of injuries to most patients involved in fires. Burning characteristics and the interval between the onset of heating and ignition (ignition time) may vary with the fibre type. It may be influenced by the yarn and fabric construction and the manner and conditions under which they are used.

5.2 Synthetic fabrics such as polyester, FR polyester, nylon and blends of natural and synthetic fibres, polyester/viscose or cotton, and of course, cotton and wool with, to a lesser extent, modacrylic fibre fabrics, are now commonly used in health care.

5.3 The synthetic fibres used are thermoplastic with relatively slow burning, and some melting occurs when certain temperatures are reached. In many cases of an unrestricted fabric, but not with acrylic, this allows the hot melt, quite often with flame, to drop away, leading to the extinction of the flame - although the life of flaming droplets can be influenced by the material on which they land. Polyester fibre, commonly used for fillings in clothing and bedding to aid warmth retention, has modified burning characteristics when contained in this form. Containment of the melt within the fabric enclosure prevents 'drop away' and flame extinction, resulting in rapid flame spread, and high rate of heat release. FR polyester should be used as a filling material in these products.

5.4 Wool is inherently flame retardant but the flame retardancy can be influenced by fabric mass and construction. Low weight open-weave wool fabrics below 140 grammes per square metre (gsm) should not be used. The FR effectiveness of wool, depending on weight and construction, can be increased by a chemical finish although it will still burn if exposed to an intensive heat source.

5.5 Man-made viscose fibres, except those containing FR additives, as well as cotton, and blends of cotton with other man made fibres, will burn and depending on their condition of use, will be destroyed. Chemical finishes which lower the fire hazard of some of these fibres are available and in use.

5.6 Two synthetic fibres with vastly different hazard levels are acrylic and modified acrylic (modacrylic). Acrylic fibre fabrics should not be used in health care; they are a high fire risk. Modacrylics, however, will considerably lower the fire hazard level for clothing and bedding, and for many applications, where the laundries are conversant with this fibre, their use is to be encouraged.

5.7 Low fire hazard level materials will help to provide a safer environment against fire, but note must be made of recommended constructions and mass for a particular product and the manner of its use. These factors can alter the important delay time to ignition and eventual burning behaviour. Bed assemblies in which the sheets, blanket and counterpane are all made from 100% spun polyester should not be used. It is recommended that the blanket and/or counterpane should be made from cotton treated with Proban or Pyrovatex (but see paragraph 4.2) or from modacrylic or 100% FR polyester. Alternatively, a bed assembly in which the sheets, blanket and counterpane are all made from 100% FR polyester is suitable.

Blankets

5.8 The following four types of blankets are recommended for high fire risk areas.

Wool (reduced fire hazard level treated)

5.8.1 This remains a recommended blanket for high fire risk areas and should be purchased to BS 5866: Part 1 and with the International Wool Secretariat flame retardant treatment (ie ZIRPRO process) to meet the requirements of BS 5866: Part 3.

Cotton cellular (reduced fire hazard level treated)

5.8.2 Cotton blankets should be purchased treated with Proban or Pyrovatex and should meet the flammability requirements of BS 5866: Part 3 after 200 washes. The construction of the blankets should be in accordance with BS 5866: Part 2.

Polyester cellular

5.8.3 100% spun polyester and 100% spun FR polyester blankets are available in woven and knitted constructions. They should meet the requirements of BS 5866: Part 3 including flammability.

Modacrylic cellular

5.8.4 Modacrylic blankets should meet the requirements of BS5866: Part 3 including flammability.

Sheets and pillowslips

5.9 Sheets have long posed a problem in the provision of both comfort and a low fire hazard level. Additive treatments that are effective in lowering the fire hazard level of cotton and other cellulosic fibres can give fabrics a harsher handle. Cotton, treated with either the Proban or Pyrovatex process, meets the requirements of BS 5867: Part 2 (paragraph 5.3 amended) after 200 washes.

5.10 Both systems can provide acceptable low fire hazard level sheets and pillowslips but at a considerably increased cost.

5.11 100% spun polyester, and 100% FR polyester fabrics, are gaining acceptance as providing comfort, low flammability, and reduced laundry costs. 100% spun polyester may however burn with a small lingering flame if ignited, and a constraint in using this material with other bedding materials is outlined at paragraph 5.7.

Counterpanes

5.12 Counterpanes should be flame retardant. They should be kept on the bed at all times and, consistent with the nursing requirements, should cover the other bedding textiles as completely as possible.

5.13 Counterpanes are available under NHS national contracts in curtain fabric to a minimum mass of 270 gsm. Cotton counterpanes are FR treated to meet contract flammability requirements using the Proban or Pyrovatex process. Dobby weave counterpanes to the mass and weave constructions of DH Specification TSS/S/310,535 (see HSSPG, Section V) are acceptable if Proban or Pyrovatex treated to meet the requirements of BS 5867: Part 2 (paragraph 5.3 amended) after 200 washes. FR polyester or modacrylic woven counterpanes of a minimum mass of 270 gsm are acceptable provided they meet the requirements of BS 5867: Part 2 (paragraph 5.3 amended) after one wash. Counterpanes should also meet the flammability requirements of FTS 5 using ignition sources 0 and 5.

5.14 Any of the types of counterpane detailed above may be used in high risk areas but it is stressed that they should meet the relevant requirements.

Quilts

5.15 It is acknowledged that quilts (continental quilts, or duvets) provide a high ratio of warmth for weight and permit greater freedom of movement for the patient. There is also an advantage in simplicity of bed making. There are, however, difficulties in laundering because of their greater bulk.

5.16 The present difficulty with quilts of the type most likely to be used in hospitals (ie those having a polyester filling), is the increased fire hazard over the more conventional hospital bedding where a FR counterpane is used. Some currently available types of quilts, even if provided with FR covers, increase the bed fire hazard. Polyester filling will flame rapidly within the containment of a cover when molten fibre cannot drop away. FR covers can 'break through' at a charred area allowing combustion of the filling or, if a polymer fibre is used as a cover (eg polyester) molten fabric from a small ignition will 'hole' the cover allowing possible combustion of the filling.

5.17 The use of FR polyester infill, of which several types are available, will, in combination with a complementary cover, give a low fire hazard level quilt.

5.18 The four types of quilt ('continental') listed in HSSPG Section V are acceptable and satisfy the requirements of FTS 5 using ignition sources 0 and 5. In addition, these types of quilt, when provided with FR secondary cover in either Proban or Pyrotavex treated cotton, 100% modacrylic or 100% FR polyester, will also satisfy the requirements of FTS 5, ignition source 4.

Note: Secondary covers may be constructed with 220 gsm face and back, 220 gsm face and 145 gsm back, or with 145 gsm face and back.

Fleece underlay and padding - washable

5.19 Numerous products of the above description are used in the nursing care of pressure sores. As they are usually placed within the bed assembly, or on easy chairs or wheelchairs, it is desirable that they have a certain degree of flame retardancy that is not removed on laundering. The fleeces and pads should meet the requirements of FTS 5 using ignition sources 0, 1 and 5. The backing of the fleeces should also meet the requirements of BS 5867: Part 2 Type C (paragraph 5.3 amended) using BS 5438 (5, 15 and 20 seconds flame application times).

Patient supports

Mattresses and mattress covers

5.20 Any supporting surface on which a patient lies must not adversely affect his or her condition. A good support should provide as extensive an area of support as possible to reduce the load taken by the prominent bony areas, as an aid to inhibiting the development of pressure sores. These requirements are most economically achieved at present by the use of the NHS national contract polyurethane foam

mattress, with a polyurethane coated nylon fabric waterproof cover and with only one textile sheet between patient and mattress. Other conventional mattresses are much less effective, but there is a range of support surfaces available for patients at greater risk from pressure sores.

5.21 The NHS national contract spring interior mattress is also recommended where clinically superior postural support is not essential (although it will provide superior support compared with other types of spring interior mattresses). The mattress should meet the requirements of BS 6807 Section 2 ignition sources 0 and 5.

5.22 Combustion modified FR foam suitable for a hospital mattress has been developed to meet Schedule 1 Part 1 of the flammability requirement of the Furniture and Furnishings (Fire) (Safety) Regulations 1988. This requirement is a BS5852: Part 2 test with a specified FR polyester flat woven cover over the foam. A pass result is achieved with ignition source 5 crib and compliance with a specified mass loss. A NHS national contract has been placed for a mattress of this type and as it does not require an outer FR cover, it is not dependent for its safety upon a cover remaining intact as is the case when non-FR foam is used (see also paragraph 8.15).

5.23 FR protection is provided for the non-FR foam mattress by fitting a FR stretch primary cover which conforms to mattress body loading deformation criteria. This is available for fitting to mattresses already in use in hospitals. It should be fitted between the polyurethane coated nylon cover and the foam core of the mattress. It can also be fitted to the spring interior mattresses, whether or not used in conjunction with the proofed nylon mattress cover. This primary cover on this foam core has been successfully tested to BS 6807 Section 2 ignition sources 0 and 5.

Note:- When worn out or damaged, this type of foam mattress assembly should be replaced by the national contract mattress described at paragraph 5.22.

5.24 A brief description of this cover is: knitted loop pile single jersey stretch terry fabric. The pile may be composed of inherently flame retardant viscose or Proban or Pyrovatex treated cotton/viscose blend. The minimum weight of the fabric shall be 250 gsm or in the case of the viscose 300 gsm.

5.25 A non-FR polyurethane foam mattress must not be used without a FR cover.

Note:- It is recommended that only NHS national contract mattresses are purchased.

Pillows

5.26 Pillows do not present a serious initial hazard since fires do not generally originate in them but they can add to the fuel load in a bed fire. Subject, therefore, to nursing considerations, the fewer used for support purposes the better. In risk areas, pillows with an infill of non-FR polyurethane foam or feathers are used with a fixed Proban or Pyrovatex treated primary cover. Pillows with an infill of FR polyester are suitable for use when enclosed with this cover or the knitted stretch terry fabric as described in paragraph 5.24 above.

Note:- When worn out or damaged the above type of foam pillow should be replaced by one with combustion modified FR foam (as at paragraph 5.22 but of a suitable density for pillows), or one with above alternative infill.

6. Apparel

General

6.1 Clothing suitable for patients in hospitals that will afford comfort, wash/wear properties and appearance retention is not readily available in FR fabrics. Machine washable, easy care clothing should be purchased if possible but care should be taken in selection of fabrics for those at risk (eg the careless smoker).

Acrylics eg. Courtelle, Acrilan, Orlon are highly flammable and should not be used.

Sleepwear

6.2 Fabrics for these garments must meet BS 5867: Part 2 (paragraph 5.3 amended) and should be 100% spun FR polyester or modacrylic in plain weave with a minimum weight of 120 gsm to provide a low fire hazard, comfort, and easy laundry care. Cotton sleepwear, provided it is Proban or Pyrovatex treated, is also recommended but greater care in laundering will be needed otherwise garment appearance will suffer. If available, FR viscose is acceptable but caution must be exercised with laundry treatment to provide an acceptable finish. Polyester/cotton, acrylic, viscose or untreated cotton should not be used.

Dressing gowns and bed jackets

6.3 Fabrics should meet BS 5867: Part 2 (paragraph 5.3 amended). Wool or modacrylic are equally satisfactory from a flame retardancy point of view. Wool may be chemically treated for improved flame resistance safety and will naturally provide comfort and appearance. Quilted dressing gowns and bed jackets (which will most probably contain a polyester or acrylic fibre filling) should not be used. A 76% modacrylic/24% polyester knitted terry pile fabric is recommended for dressing gowns. A Proban or Pyrovatex cotton terry pile fabric is also suitable.

7. Disposables

Sheets, pillowslips, drapes and bibs

7.1 Disposable products are increasingly being used as emergency alternatives when supplies of conventional textiles are interrupted. Special care is needed as those at present available have a high fire risk being made from paper and textile materials. Even treated disposables suitable for hospital use, while being marginally safer, should be used with caution.

7.2 It is not intended to discourage the use of disposables but Hospital Equipment Information Bulletin No 85, item 57/80, draws attention to the difficulty of supervising patients who smoke. It includes details of an incident in which a patient sustained first degree burns when disposable sheets and bedding were ignited. The danger of rapid ignition of disposable bedding cannot be overstated when patients smoke in bed, and particularly so if they are immobile.

7.3 FR disposable feeding bibs are now available and should be used where appropriate.

Incontinence pads

7.4 Disposable incontinence pads can be easily ignited, even when in use. No flame retardant type of pad is available. See HEI Bulletin No 85 item 57/80 as above. Storage in open stacks may result in a serious hazard if ignited, but storage in closed containers will reduce the contribution to early fire development.

8. Fire Behaviour

Reaction to fire

Furniture

8.1 Solid timber in furniture is a relatively low fire risk until a fire has gained a stronghold. Whilst relatively difficult to ignite in the first place, it can contribute significantly to the fire once it is alight. The volume of such furniture and its positioning within a given space is significant to the spread of fire.

Textiles

8.2 While various processes may take place when a textile is exposed to a heat source, the important factor is that only a relatively small heat output is normally required to bring about thermal decomposition and in most cases initiate combustion. A match flame or a glowing cigarette will decompose, at least locally, most commonly used textiles.

8.3 Ignition occurs when the flammable products from the thermally decomposed textile are heated in the presence of oxygen. Because textiles are generally used in the form of 'thin' fabrics, there is normally a large excess of available air, and consequently a small ignition is usually sufficient to cause ignition with flaming, although in some cases, only smouldering or glowing may occur. Generally, the heavier the fabric the longer the igniting flame must be applied to initiate combustion, most of this time being required to bring about sufficient thermal decomposition.

8.4 The effect of burning textiles on surrounding atmosphere is important in communal situations such as hospitals where, apart from their extensive use, textiles may also be stored in the vicinity. However, the effect of the non-textile materials which are burning, for example polyurethane foam, is likely to be greater than the effect of the textile part of the fire. Storage of textiles in closed containers will reduce the contribution to early fire development.

8.5 A flammable textile material does not normally stop burning until all the fabric in the area of combustion has burnt away. In certain circumstances, burning in a closed atmosphere may cease before all the fabric is consumed because of lack of oxygen.

Apparel

8.6 Flame spreading in garments depends both on the fabric and the garment design. Dresses made from cotton or polyester/cotton will burn to completion causing extensive injury to over 70% of the body. Dresses made from polyester, high temperature polyamide (nylon) or FR cotton fabrics, will rarely sustain combustion in single layer garments. The typical pattern of flame spread for cotton and polyester cotton dresses ignited at the front hem is up the front of the dress from the point of ignition (although not always reaching the shoulders) and then relatively slowly around the back of the dress.

8.7 Generally, an undergarment (dress/slip) that is not flame retardant under a flammable fabric dress will not affect the burning duration or heat transferred in the case of cotton or polyester/cotton fabrics. On the other hand, FR undergarments do show a reduced burn area; even a bra will provide some protection although panties will not. As mentioned above, design does have some bearing on garment flammability. In properly fitted slacks ignited at the knee, flame propagation will be slower than for the same material in a skirt ignited at the hem. Loose trousers, perhaps oversize at the waist and supported with braces, will give an enhanced rate of flame propagation. A belt in a dress will slow down the rate of flame spread and thus reduce the area of burn, although A-line dreses tested on dummies have shown that if made from polyester, wool or FR cotton fabrics, little heat is transferred causing less than two per cent of skin burns on the body.

Polyurethane foam

8.8 Previous comments about the progressive reaction of textiles to fire apply also to foam, but the severity of flaming of foam is governed by another variable - the tendency to melt or drip. Polyurethane foam will show this tendency along with a higher heat flux and a rapid increase in the smoke level. Also, a possible build-up of a layer of hot gases beneath the ceiling could produce high heat radiation levels on materials below.

Hazards from burning materials

Heat transfer

8.9 The burning of textiles is largely dependent on their ability, once ignited, to produce sufficient heat to cause thermal decomposition of additional fabric and combustion of their decomposed products. A large

excess of heat is produced from a burning textile which is sufficient to cause ignition of other flammable material in the vicinity or to cause severe burns to the skin over the short separation distances of normal apparel. Certain fabrics either remain unaffected by heat exposures or form a solid residue. The insulating effect of this fabric or fabric residue may be important in preventing heat transfer from the igniting source to other materials or to the skin. On the other hand certain fabrics produced from thermoplastic fibres, which melt and shrink away from the ignition source forming a hole without igniting, do not provide this barrier effect. Since such fabrics do not readily propagate flame, the hazard from small ignition sources is presented by their melting characteristics and heat transfer from the molten fibres.

8.10 Heat transferred from flame and hot gases is the direct cause of skin injury. Fabrics which burn rapidly can transfer enough heat to cause 'whole skin loss' burns while fabrics which burn only for a short distance and then extinguish themselves will transfer only small amounts of heat.

8.11 Polyester is a restricted burning fabric transferring little heat while acrylic fabric burns rapidly and extensively, transferring sufficient heat to cause deep and extensive burns. Polyester/cotton and cotton alone lie between these two with the former transferring less heat than the latter.

8.12 Polyester fabrics present little hazard from heat transferred from flame and convected hot gases to adjacent skin, although falling molten drips of material can be a local hazard to the ankles and feet of the garment wearer. The heat of molten material is very small compared with that from an area of burning cotton fabric.

Toxicity

8.13 When textiles burn most of the gaseous decomposition products are toxic and when large quantities of fabric are burning the volume of such products may be sufficient to endanger life. Other gaseous products and smoke particles irritate the eyes making it difficult to find escape routes, while the respiratory tract is affected making it difficult to breathe. These effects may not be dangerous in themselves, but they cause panic and fear which considerably increase the danger inherent in any fire.

8.14 The behaviour of many synthetic polymers eg polyurethane foam, in a fire differs considerably from that of more traditional materials. The situation is complicated by the mixing of numerous ingredients and their potential interaction. Fire hazards posed by such interactions are not yet fully understood. As with this foam's tendency to melt or drip and cause higher heat flux and smoke levels, the relative toxicity of combustion products of the material does cause concern and presents a very serious hazard. Such foams emit a range of potentially lethal and highly toxic volatile substances, including carbon monoxide, hydrochloric acid gas, and powerful irritants such as acrolein. This is a difficult, perhaps even an intractable field of study, and significant advances in understanding these matters should not be expected in the near future.

8.15 Polyurethane foam slab that meets the test requirements (ignition source 5 plus a mass loss requirement) detailed in the Furniture and Furnishings (Fire) (Safety) Regulations 1988 (Schedule 1, Part 1) and has the FR quality throughout its thickness, represents probably the safest foam available in 1988 for use in health care premises. These test requirements concern ignitability performance and qualities of slow burning and consequential production of reduced heat, smoke and toxic gases. They do not stipulate acceptable measures of these qualities but should provide a reliable discriminator between safer and less safe foams. Barrier foam, which is a FR foam envelope around a non-FR foam core, can give comparable ignitability performance and possibly similar levels of toxic gas emission. However, it is overall less safe because of the possibility of exposing the non-FR foam core to fire should the protective barrier foam wrap be accidentally or intentionally ruptured. That is, the barrier foam product, eg a mattress, is dependent for overall comparable safety on the barrier remaining intact.

Testing for fire behaviour

Textiles

8.16 Testing textiles for fire behaviour provides information on time from application of flame to ignition (ease of ignition), the rate of flame spread, the extent of flame spread, and general behaviour such as shrinkage and melting. More specialised testing provides information on smoke obscuration and the toxic products of combustion.

8.17 Textiles for garments and curtains are tested by using vertically orientated strips. A British Standard method of test for horizontal fabrics which correctly simulates the use orientation of bed textiles and coverings should be available in 1989.

Upholstery materials

8.18 From the results of various research projects to determine the fire properties of furniture, it was found with upholstery fabrics, as with other materials, that only when the finished item of furniture was tested could a true indication of their behaviour in fire be obtained. In BS 5852: Part 1 and Part 2 the principle of the test procedure is to subject to ignition a fabric and foam composite arranged to represent, in stylized form, the join between the seat and back (or seat and arm) surfaces of a chair.

9. Cleansing

General

9.1 These notes primarily relate to fabrics which have been additive chemically treated with Proban or Pyrovatex for fire retardancy. They are not intended as detailed laundry process instructions, but are included to illustrate the laundering process for those fabrics for the information of all concerned with the selection, purchase and use of textile items. As there are many variations in the types of washing and finishing equipment in laundries, individual Linen Service and Laundry Managers will formulate the appropriate washing processes which should be followed to retain the flame retardant effectiveness of chemically treated fabrics.

Flame retardant cotton fabrics

Loading factor

9.2 The normal loading factor for cotton articles is satisfactory, but white and coloured fabrics should not be washed in the same load.

Wash

9.3 Generally, the two-wash process will be satisfactory. This means a breakwash or first wash to remove surface soiling, and a second wash at a higher temperature and alkalinity to remove more resistant soiling and to achieve thermal disinfection.

Breakwash (first wash)

9.3.1 Net washing time 3-4 minutes, high-dip level at a maximum temperature of 32°C (90°F).

Second wash

9.3.2 Net washing time 6-8 minutes minimum (at the recommended loading factor), low-dip level, and at a minimum temperature of 71°C (160°F). The basic conditions applicable to thermal disinfection requirements are contained in HC(87)30, Hospital Laundry Arrangements.

Wash materials

9.4 To minimise the risk of masking the imparted fire retardant properties by insoluble lime soaps or mineral deposits, the use of a synthetic detergent/Carboxy Methyl Cellulose (CMC) product (preferably anionic detergent), plus the addition of an alkali, is recommended.

9.5 If the water used for both washing and rinsing is softened to zero hardness, a soap/CMC product plus the addition of an alkali may be used, but unless continual maintenance of zero hardness conditions can be guaranteed, it is safer to use only washing materials suitable for hard water conditions.

9.6 In hard water conditions soap/CMC products should not be used, and sodium metasilicate should be replaced by an alternative alkali, eg sodium carbonate.

9.7 Sodium Hypochlorite (chlorine) bleach should not be used as it will destroy the imparted FR properties.

9.8 Do not use starch or other additives as they mask the flame retardant properties.

Rinse/extraction

9.9 When washing with a synthetic detergent/CMC product, two or three rinses should be adequate, but if a soap/CMC product is used extra rinsing is recommended.

Fabrics from synthetic fibres

9.10 Fabrics of this type, such as modacrylic and polyester, are of a low fire hazard level which is not affected by the laundering process recommended for those fibres, but care must be taken in the finishing of modacrylic fibres. Generally, they are unsuitable for calendering, and excessively high temperatures must be avoided during tumbler drying.

Dry cleaning

9.11 Dry cleaning solvents do not mask or degenerate flame retardant properties. Cleaning of fabrics should be carried out according to the care label.

10. Marking

Furniture

10.1 All furniture supplied under NHS national contracts is labelled or marked as follows:-

Wooden-framed seating	) FIRE RETARDANT TO TCS/
Metal-framed seating	) FTS6, or BS 5852 IS/0/1/5
Polypropylene chairs	)

Note:- The Furniture and Furnishings (Fire) (Safety) Regulations 1988 also introduce permanent labelling requirements for upholstered furniture and non-permanent covers.

Furnishings

10.2 Items for use in health care premises should be identified by the appropriate label as follows.

Curtains

10.3 All FR curtain materials and made-up curtains purchased on NHS national contract are supplied with the standard label (10cm x 8cm) shown in Appendix 4.

Net curtains

10.4 All FR polyester net made-up curtains and net curtaining material purchased on NHS national contract will have a label supplied by the manufacturer with the following wording:-

FIRE RETARDANT TO TCS/FR 7 IGNITION SOURCE 5

Roller Blinds

10.5 Roller blinds have the manufacturer's name and date of manufacture printed on the blind material where fixed to the roller and are labelled as follows:-

FIRE RETARDANT TO TCS/FTS 17, IGNITION SOURCE 5

Textiles

Counterpanes

10.6 Counterpanes listed in paragraphs 5.12 to 5.14 should be supplied with standard labels (10cm x 8cm) shown in Appendix 4 sewn on two diagonally opposite corners.

Blankets

10.7 The standard label (10cm x 8cm) shown in Appendix 4 should be sewn onto the corner of the blankets listed in paragraphs 5.8.1 to 5.8.4.

Quilt covers

10.8 FR quilt covers, both primary and secondary should have a standard label attached (10cm x 8cm) as shown in Appendix 4.

Primary mattress covers and pillow covers

10.9 Primary covers for mattresses and pillows and treated with either Proban or Pyrovatex should have a standard label attached as shown in Appendix 4 (10cm x 8cm for primary mattress covers, and may be 5cm x 4cm for pillow covers).

Nightwear including dressing gowns

10.10 Nightdresses, dressing gowns and pyjamas in 100% FR polyester or cotton treated with Proban or Pyrovatex, modacrylic and modacrylic/polyester gowns, should have a standard label attached as shown in Appendix 4 (may be 5cm x 4cm).

Appendix 1 Relevant British Standards and The Crown Suppliers (TCS) Fire Retardant/ Test Specifications

British Standards

BS476: Part 7: 1971	Surface spread of flame tests for materials.
BS1547: 1959	Flameproof industrial clothing.
BS1763: 1975	Thin PVC sheeting, calendered flexible unsupported.
BS2483: 1977	Specification for overbed tables.
BS2963: 1958	Methods of test for the flammability of fabrics.
BS4569: 1970	Surface flash in pile fabrics.
BS4790: 1972	Method of determination of the effects of a small ignition source on textile floor coverings (hot metal nut method).
BS5287: 1976	Assessment and labelling of textile floor covering tested to BS4790: 1972.
*BS5438: 1976	Methods of test for flammability of vertically orientated textile fabrics and fabric assemblies subjected to a small igniting flame.
BS5651: 1978	Cleansing and wetting procedures for use in the assessment of the effect of cleansing and wetting on the flammability of textile fabrics and fabric assemblies.
BS5722: 1984	Flammability performance of fabrics and fabric assemblies used in sleepwear when tested to BS5438: 1976.
BS5742: 1979	Textile labels requiring to be washed and/or dry cleaned.
*BS5852: Part 1: 1979	Fire tests for furniture. Methods of test for the ignitability by smokers' materials of upholstered composites for seating.
Part 2: 1982	Fire tests for furniture. Methods of test for the ignitability of upholstered composites for seating by flaming sources.
BS5866: Part 1: 1980	Specification for wool and wool/nylon blankets.
Part 2: 1980	Specification for cotton cellular blankets.
Part 3: 1983	Specification for synthetic fibre blankets.
*BS5867: Part 2: 1980	Specification for curtains and drapes. Flammability requirements.
BS6807: 1986	Methods of test for the ignitability of mattresses with primary and secondary sources of ignition.

*These Standards are in process of revision.

TCS Fire Retardant Specifications (FR) and Fire Test Specifications (FTS)

FTS No 3 - Amdt Nov 83	Methods of test for assessing upholstery barrier fabrics for resistance to accidental ignition.
FTS No 5 - Amdt Jan 87	Methods of test for assessing the ignitability of bedcovers by smouldering and flaming sources.
FTS No 6 - Amdt Mar 86	Fire standard for seating - method of test.
FR No 7 -	Methods of test for assessing the ignitability of curtains.
FR No 14 - Issued Apr 78	Ignition standard, archival storage - method of test.
FTS No 15 - Amdt Dec 84	Methods of tests for assessing the ignitability of a vandalised mattress by a flaming ignition source.
FTS No 16 - Not issued	Methods of test for assessing office screens for resistance to accidental ignition.
FTS No 17 - Issued Jul 87	Methods of test for assessing the flammability of internal window blinds by a flaming ignition source.

Note: Part of TCS FTS 5 incorporated into BS 6807. Remainder being incorporated into new British Standard.

TCS FTS6 being incorporated into revision of BS 5852.

British Standards and TCS Specifications are subject to review and amendment from time to time.

British Standards can be purchased from:-

BSI Publications Manager,
195 Pentonville Road,
London N1 9ND
or
10 Blackfriars Street,
Manchester M3 5DT.

TCS Specifications are available from:-

The Librarian
The Crown Suppliers
Wellington House
133 Waterloo Road
London SE1 8UG.

Appendix 2 Garment Label Trade Name - Low Hazard Level Fibres.

Garments labelled with the fibre trade names listed below have a low fire risk and are suitable for patients in health care premises.

Identification of Synthetic Fabrics

Generic Name	Trade Name	Manufacturer
POLYESTER	TETORON	TEIJIN
	TERYLENE	ICI
	TREVIRA	HOECHST
	DACRON	DUPONT
	TERLENKA	ENKA BY
	DIOLEN	ENKA AG
FLAME RETARDANT POLYESTER	TREVIRA 270CS	HOECHST
	TREVIRA 271FR	HOECHST USA
	DACRON D81	DUPONT
	FIDION	ENICHEM
MODACRYLIC	TEKLAN	COURTAULDS
	ACRILAN SEF (SEE FOOTNOTE)	MONSANTO
	VELICREN FR AND FRS	SNIA
ARAMIDE (POLYAMIDE)	NOMEX	DUPONT
CHLOROFIBRE	CLEVYL	

Care must be exercised to ensure that the garment label indicates manufacture in 100% fibre from one of these trade names or in a blend of these fibres only. A blend example might be - SEF Acrilan 75%, Terylene 25%. The list is not exhaustive but it gives trade names for commonly used low hazard level fibres currently available from retail and/or contract outlets. Garments whose labels indicate the use of an unlisted fibre, either by itself or in a blend, should be regarded as flammable.

Note: Acrylics are highly flammable. The Acrilan trade mark should be used only when accompanied by the letters SEF as above.

Appendix 3 Flame Retardant Treatments

Treatment of in-situ items

A number of proprietary processes for treating furniture and fabrics in-situ to make them flame retardant are being marketed. These should be treated with utmost caution. It is extremely difficult to test whether the treatment has been applied evenly and adequately and the performance of such treatment is largely unknown. In some cases the chemicals leach out or can be removed by sponging or washing. Only permanent finishes are recommended, such as Proban and Pyrovatex for certain textiles.

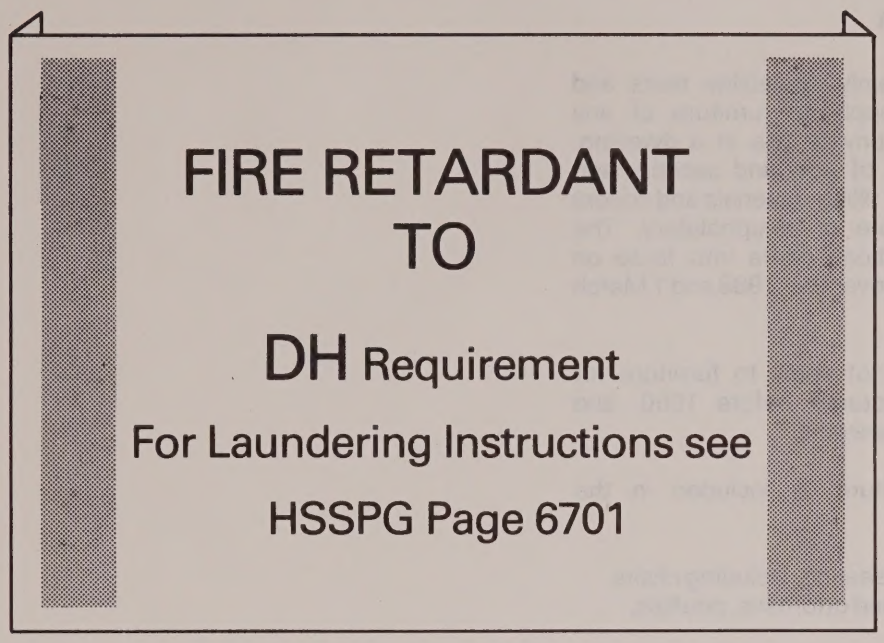
Treatment of made-up items

Made-up textile items such as clothing, blankets and curtains, can be treated successfully with either Proban or Pyrovatex processes. Items should be new, in cotton only, and the labels detailed in Appendix 4 must be attached appropriately to each item treated.

Flame retardant chemical system additives or finishes.

Type	Name	Fabric	Manufacturer or Chemical Agent
Vinyl phosphonate oligmer	Pyrol		
Organic Phosphorus compound	Pyrovatex CP	Cotton	Ciba Geigy
Tetrakis hydroxymethyl phosphonium chloride	Proban CC	Cotton	Albright and Wilson
Zirconium	Zirpro	Wool	International Wool Secretariat
Vinyl acetate copolymer with antimony oxide/hologen complex	National EP1713		
Ammonium phosphate - sulphate	FSM1		

Appendix 4 DH Fire Retardant Label - to comply with BS 5742



Ends of Label to be folded back and pressed to form double thickness

10mm green side borders and green lettering

Sizes of Label:

10cm wide x 8cm - as illustrated (but not to scale) and 5cm wide x 4cm.

Appendix 5 The Furniture and Furnishings (Fire) (Safety) Regulations 1988

Scope of Application

1. The Regulations (mainly ignitability tests and labelling requirements) apply to furniture of any description intended for private use in a dwelling. They concern the supply of new and second-hand furniture and the supply of filling materials and covers used in their manufacture or re-upholstery. The provisions of the Regulations come into force on various dates between 1 November 1988 and 1 March 1993.

2. The Regulations do not apply to furniture for export, furniture manufactured before 1950, and furniture in second-hand caravans.

3. The following 'furniture' is included in the Regulations:-

All types of upholstered seating, including chairs, settees, padded stools and ottomans, pouffes, sofa beds.

All furniture with upholstered (padded) areas, eg headboards.

Children's furniture, cots, carry cots, playpens, prams and pushchairs, high chairs.

Furniture for use in the open air (garden furniture), upholstery in caravans.

Mattresses and divans.

Scatter cushions, pillows.

4. The guidance given in this Memorandum on products for use in health care premises and included within the above list should ensure that they are no less safe than the corresponding products intended for private use in a dwelling and subject to these Regulations.

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